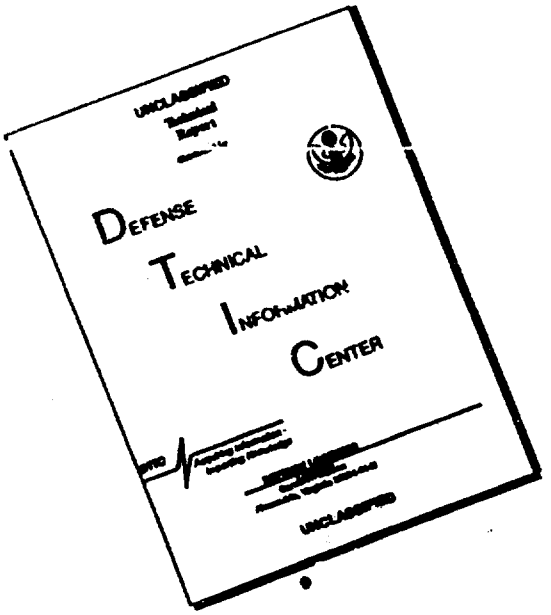
DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

DISTRIBUTION OF REPORTS

REPORT NO. [illegible]

DATE DISTRIBUTED [illegible] NO. OF COPIES 6

Author — 1

Lab. File — 1

Main Office File

Chief of Ordnance

Springfield Armory

Watervliet Arsenal

Rock Island Arsenal

Frankford Arsenal

Picatinny Arsenal

Aberdeen Proving Ground

Extra Copies

Other establishments requesting work.

[illegible]

[illegible] - 1

BROKEN ROUTING TOOL REPORT

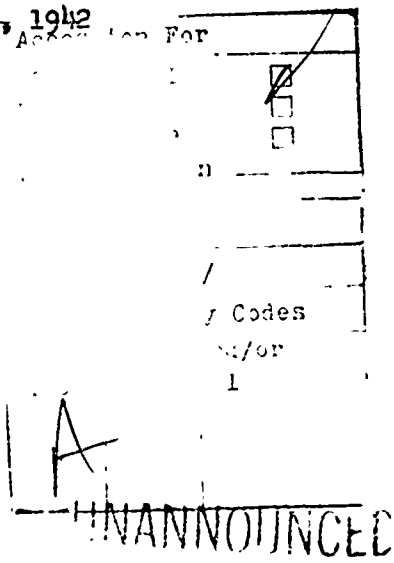
MR. H. G. CARTER

JUNE 29, 1942

/mlc

Report No. 315/16
Watertown Arsenal
(Ex. O. J115)

June 29, 1942



TOOL STEELS

Broken Routing Cutter

OBJECT

To ascertain the cause of failure.

CONCLUSION

The breakage was due to a combination of several factors:

1. The steel showed faulty steel mill manufacture as indicated by the large size, shape, and arrangement of the carbides.

2. The tool was too hard for the class of work it had to perform. (Rockwell C62-63).

3. The design provided too small a fillet between the shank and body of the tool.

AUTHENTICATION

The investigation was requested by Mr. C. A. McCarthy, foreman of the Woodworking Department, Watertown Arsenal, work order J115.

INTRODUCTION

A square-shouldered routing tool made of high speed

steel broke while working on clear pine. The tool was furnished by C. O. Porter Machinery Company, Grand Rapids, Michigan. It revolves at 12000 R.P.M. No safety guards are on the machine, and none can be readily applied. This makes the machine dangerous if a tool breaks.

DISCUSSION

The attached micrographs show the carbides are generally very large, non-uniform in size and irregularly shaped. The smaller carbides found in the high magnification illustration are about the size found in good quality high speed steel.

The character of the carbides in this cutter should have caused rejection of the steel by the manufacturer.

The austenitic grain boundaries clearly seen in the high magnification illustration indicate insufficient tempering, hence undue brittleness.

The Rockwell hardness of C62-63 may be normal for high speed steels used to cut steel at a much slower speed. It is believed that for wood cutting, and at the high speed of 12000 R.P.M., a Rockwell hardness of C50-55 should be sufficient and not be so brittle as with a hardness of C62-63.

The fracture passed from the center of rotation at the bottom cutting face diagonally to the junction of the shank and tool body at the top. At this junction the

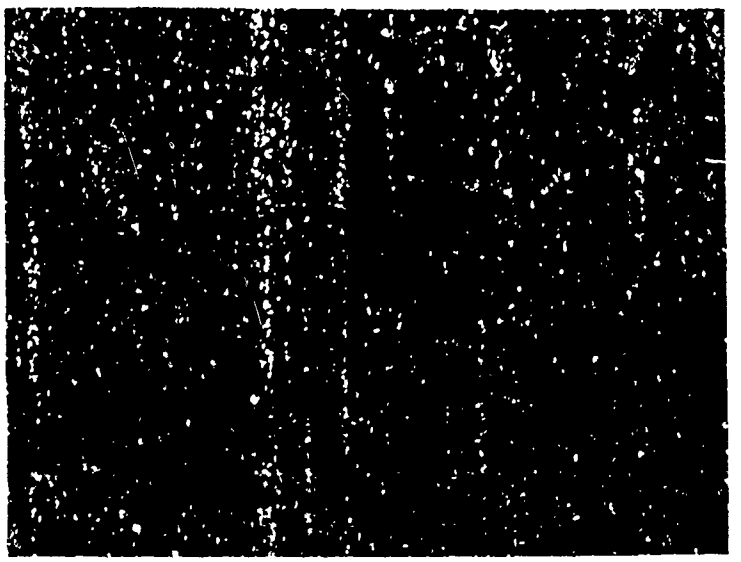
fillet was very small, so small that it may be questioned if the fillet was intended, or was from accidental grinding of the forming tool. Inasmuch as the stress concentration approaches the maximum at this junction, a suitable fillet should be provided.

H. G. Carter
Associate Metallurgist

APPROVED:

H. H. Zornig
Colonel, Ord. Dept.
Director of Laboratory

Broken Routing Tool.



X100

X1500

W.A. 532-4076